

IBC SDC C versus D — Effect on LANL Design

A companion to ESM Chapter 5 Section II (Rev. 11) to guide EOR implementation of its new provisions for use of SDC C for certain RC I and II structures

(ref. Section II article 1613.3 Seismic ground motion values, “Exception,” “Conditions,” etc.)

Note: Print on legal paper for best results.

The 1st column of the table contains provisions from the 2015 IBC (to include standards referenced therein) that affect SDC C (& below) and SDC D (& above) differently. The 2nd column contains the effects of the provisions in SDC C. The 3rd column contains the effects of the provisions in SDC D. The 4th column contains the applicable code/standards and where the provisions are located therein. Finally, the 5th column contains LANL Standards (e.g., ESM, Master Spec templates, Details, etc.) that haven’t been edited for the effects of the provisions indicated herein at time of writing; an entry of “N/A” in the 5th column means that no editing of LANL Standards is needed vis-à-vis the provisions indicated herein (other than authors editing LANL Master Spec sections or other template where SDC-related wording options and authors notes are now provided for their benefit).

****Disclaimer: While this document is believed to be complete and accurate, the EOR is responsible for all design outputs being correct****

Provision	SDC C	SDC D	Code/Standard	LANL Standard ¹²
Design of Seismic Force-Resisting Systems (SFRSs) in Seismically-Isolated Structures.	SFRSs above seismic isolation systems must comply with ASCE 7 Ch. 17.	OMFs & OCBFs above seismic isolation systems can be up to 160’ provided two (2) conditions are satisfied.	IBC 1613.4.1	N/A
Structural Observations for Seismic Resistance	Structural observations for seismic resistance aren’t required.	Structural observations for seismic resistance are required when one (1) or more of five (5) conditions exist.	IBC 1704.6.1	N/A
Special Inspections of Structural Steel in SFRSs	Special inspections of structural steel in SFRSs of buildings & structures aren’t required if $R \leq 3$, excluding cantilever column systems.	Special inspections of structural steel in SFRSs of buildings & structures are required.	IBC 1705.12.1.1	N/A
Special Inspections of Structural Steel Elements in SFRSs	Special inspections of structural steel elements in the SFRSs of buildings & structures aren’t required if $R \leq 3$.	Special inspections of structural steel elements in the SFRSs of buildings & structures are required.	IBC 1705.12.1.2	N/A
Special Inspections of Certain Architectural Components	Special inspections of the erection & fastening of exterior cladding, interior & exterior nonbearing walls & interior & exterior veneer aren’t required.	Special inspections of the erection & fastening of exterior cladding, interior & exterior nonbearing walls & interior & exterior veneer are required (unless exceptions for height &/or weight met).	IBC 1705.12.5	N/A
Special Inspections of Storage Racks	Special inspections of storage racks aren’t required.	Special inspections of the anchorage of storage racks $\geq 8'$ in height are required.	IBC 1705.12.7	N/A
Special Inspections of Cold-Formed Steel (CFS) Special Bolted Moment Frames (SBMFs)	Special inspections of CFS SBFMs in SFRSs aren’t required.	Special inspections of the installation of CFS SBFMs in SFRSs are required.	IBC 1705.12.9	N/A
Testing of Structural Steel in SFRSs	Testing of structural steel in SFRSs of buildings & structures isn’t required if $R \leq 3$, excluding cantilever column systems.	Testing of structural steel in SFRSs of buildings & structures is required.	IBC 1705.13.1.1	N/A
Testing of Structural Steel Elements in SFRSs	Testing of structural steel elements in the SFRSs of buildings & structures isn’t required if $R < 3$.	Testing of structural steel elements in the SFRSs of buildings & structures is required.	IBC 1705.13.1.2	N/A

¹ Not included herein are instances in which the Seismic Design Category (SDC) is stated as being D (unrelated to an IBC provision). Thus, for “SDC-C projects,” in addition to accounting for the items listed in this column (that apply to project), the SDC will need to be edited (from D to C) in those LANL Standard documents (that are used by the project) that state the SDC is D.

² With regard to LANL Standard Details, where seismic load governs (the design) over wind, & where $I_p = 1.5$, the reduction in design accelerations (i.e., S_{Ds} & S_{D1}) could have an effect on the result (regardless of SDC).

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Geotechnical Investigations & Dynamic Seismic Lateral Earth Pressures (DSLEPs).	Geotech investigations need not include the determination of DSLEPs.	Geotech investigations shall include the determination of DSLEPs on foundation walls & retaining walls supporting more than 6' of backfill height ³ .	IBC 1803.5.12	ESM Ch. 5 Sect. IV r6: - Paras. F & G in Sect. 5.0 are based on SDC D (only).
TMS 402 Seismic Design Requirements & IBC Prescriptive Design of Masonry Foundation Walls	Prescriptively-designed masonry foundation walls shall comply w/ TMS 402 para. 7.4.3.	Prescriptively-designed masonry foundation walls shall comply w/ TMS 402 para. 7.4.4.	IBC 1807.1.6.3.2	N/A
Min. Specified Compressive Strength of Concrete & Grout (f'c) in Foundations	f'c = 2500 psi	f'c = 2500 psi for U occupancies of light-frame construction that are ≤ 2 stories in height. f'c = 3000 psi for other structures.	IBC 1808.8.1	N/A
ACI 318 Seismic Design Requirements & Concrete Foundations	ACI 318 seismic design requirements N/A to concrete foundations.	ACI 318 Sect. 18.13 ⁴ applies (except for para. 18.13.4.3(a)) where not in conflict w/ IBC 1808 – 1810, to concrete foundations.	IBC 1808.8.6	N/A
Shallow Foundations of Masonry for Structures	Subject to complying w/ five (5) requirements, pier & curtain wall foundations ⁵ are permitted for light-frame construction ≤ 2 stories above grade.	Pier & curtain wall foundations aren't permitted.	IBC 1809.10	N/A
Shallow Foundations & Seismic Ties	Shallow foundations need not be tied together.	In Site Classes E & F, spread footings must be interconnected by ties.	IBC 1809.13	N/A
Analysis for Lateral Loads on Deep Foundations & Seismic Design Requirements	There are no seismic design requirements associated w/ the analysis for lateral loads on deep foundations.	Unless one (1) of two (2) exceptions is met, there are seismic design requirements that must be included in the analysis for lateral loads in Site Classes E & F.	IBC 1810.2.4.1	N/A
Design & Detailing of Precast Nonprestressed Piles (PNPs) & Additional Seismic Reinforcement	No additional transverse reinforcement (above & beyond that required by 1810.3.8.2.2) is required for PNPs.	Additional transverse reinforcement complying w/ 1810.3.9.4.2 ⁶ is required in PNPs.	IBC 1810.3.8.2.3	N/A
Design & Detailing of Precast Prestressed Piles (PPPs) & Additional Seismic Reinforcement	No additional transverse reinforcement (above & beyond that required by 1810.3.8.3.2) is required for PPPs.	Additional transverse reinforcement complying w/ six (6) provisions is required in PPPs.	IBC 1810.3.8.3.3	N/A
Design & Detailing of Cast-In-Place (CIP) Deep Foundations (CDFs) & Additional Seismic Reinforcement	No additional longitudinal & transverse reinforcement (above & beyond that required by 1810.3.9.4.1) is required for CDFs.	Additional longitudinal & transverse reinforcement is required in CDFs.	IBC 1810.3.9.4.2	N/A
Design & Detailing of Micropiles & Seismic Reinforcement	Seismic reinforcement shall be as stipulated.	Micropiles shall be considered as an "alternative system (per 104.11)."	IBC 1810.3.10.4	N/A
Design & Detailing of Pile Caps & Additional Requirements on Resistance to Uplift and Rotational Restraint.	No additional uplift requirements (above & beyond those required by 1810.3.11.1), & no rotational-restraint requirements, for pile connections to pile caps.	Piles shall be anchored into pile caps per the additional uplift requirements & the stipulated rotational-restraint requirements.	IBC 1810.3.11.2	N/A
ACI 318 Seismic Requirements & Design & Detailing of Grade Beams	ACI 318 seismic requirements for grade beams N/A.	Grade beams must comply w/ ACI 318 Sect. 18.13.3 ⁷ unless their design includes the overstrength factor (Ω_0).	IBC 1810.3.12	N/A

³ The potential for liquefaction & soil strength loss, assessment of their potential consequences, & discussion of mitigation measures are also required in SDC D; however, these aren't mentioned since these hazards are rarely (if ever) considered at LANL.

⁴ ACI 318 Sect. 18.13 includes the seismic-design requirements for foundations, 18.13.4.3(a) pertains to trans. rebar at/near the top of piles, piers, or caissons; & IBC 1808 is "Foundations," 1809 is "Shallow Foundations," & 1810 is "Deep Foundations."

⁵ Per IBC Commentary to 1809.10, a "pier & curtain wall foundation" is a masonry system comprised of a load-bearing curtain wall (at least 4" thick) & pilasters.

⁶ Seismic reinforcement for cast-in-place deep foundations.

⁷ Grade beams and slabs-on-ground.

Slabs on Grade (SOGs) Designed as Diaphragms & Their Identification on Construction Documents	SOGs designed as diaphragms need not be identified ⁸ .	SOGs designed as structural diaphragms must be identified via a statement.	IBC 1901.5	N/A
Masonry Heaters & Seismic Reinforcement	Masonry heaters need not have seismic reinforcement.	Masonry heaters must have the same seismic reinforcement as masonry chimneys (in 2113.3).	IBC 2112.4	N/A
Structural Steel SFRSs & AISC 341, <i>Seismic Provisions for Structural Steel Buildings</i> .	Structural steel SFRSs w/ $R \leq 3$ need not be designed & detailed per AISC 341.	Structural steel SFRSs shall be designed & detailed per AISC 341 except for certain nonbuilding structures similar to buildings (per ASCE 7 Table 15.4-1).	IBC 2205.2.1.2	N/A
Structural Steel Elements in SFRSs & AISC 341	Structural steel elements in SFRSs w/ $R \leq 3$ need not be designed & detailed per AISC 341.	Structural steel elements in SFRSs shall be designed & detailed per AISC 341 except as permitted in ASCE 7 Table 15.4-1.	IBC 2205.2.2	N/A
Wood & Gyp. Bd./Panel Products (not considered) ⁹			IBC Chapters 23 & 25, respectively	
Transition from IBC to ASCE 7				
Geotechnical Investigations & DSLEPs			ASCE 7-10 11.8.3 - See IBC 1803.5.12 (herein)	N/A
Choices & System Limitations of SFRSs	There are more choices of SFRSs, & the system limitations associated w/ them are lesser.	There are less choices of SFRSs & the system limitations associated w/ them are more restrictive.	ASCE 7 12.2.1/Table 12.2-1 ¹⁰	N/A
Requirements Associated w/ Structure Configuration Irregularities	There are fewer requirements associated w/ some of the horizontal & vertical irregularities.	There are more requirements associated w/ some of the horizontal & vertical irregularities.	ASCE 7 12.3.2 /Tables 12.3-1 & 12.3-2	N/A
Permitted Vertical Structural Configuration Irregularity	Discontinuity in lateral strength—extreme weak story irregularity is permitted.	Discontinuity in lateral strength—extreme weak story irregularity isn't permitted.	ASCE 7 12.3.3.1	N/A
Structural Configuration Irregularities & Increased Design Forces	There are no increases in design forces associated w/ irregularities.	Connections of diaphragms, & collectors & their connections, in structures having particular horizontal &/or vertical irregularities must be designed for 25% more force than what's required otherwise (by para. 12.10.1.1 ¹¹).	ASCE 7 12.3.3.4	N/A
Magnitude of Redundancy Factor (ρ) Assigned to SFRS	$\rho = 1.0$ in all instances.	$\rho = 1.3$ (vs. 1.0) in certain instances.	ASCE 7 12.3.4.2	N/A
Design of Horizontal Cantilever Structural Members for Minimum Upward Force	Cantilevers need not be designed for upward force unless it arises as a result of the load combos of Sect. 12.4 ¹²	Cantilevers must be designed for $\geq 0.2D$ net upward force in addition to that arising from applicable load combos of Sect. 12.4.	ASCE 7 12.4.4	N/A
Direction-Dependent Seismic Loading Criteria	Design forces can be applied independently in each of two (2) orthogonal directions, & orthogonal interaction effects can be neglected unless horizontal irregularity Type 5 exists.	Direction-of-loading criteria for SDC C must be met &, if a particular condition exists, an additional criterion must also be met.	ASCE 7 12.5.4	N/A

⁸ This conflicts w/ ACI 318 26.5.7.1(b), which requires EOR to identify SOG designed as a diaphragm or a part of SFRS regardless of SDC.

⁹ Although there are many IBC provisions in Ch. 23 that affect SDC C & SDC D differently, they're not considered herein since their use at LANL is "few & far between." Regarding Ch. 25, there is one (1) such provision; however, it's applicable to gyp. bd./panel ceilings on wood joists, the use of which at LANL is "few & far between."

¹⁰ And similar applies to the Simplified Alternative Structural Design Criteria for Simple Bearing Wall or Building Frame Systems (i.e., Sect. 12.14 & Table 12.14-1).

¹¹ Diaphragm Design Forces

¹² Seismic Load Effects and Combinations

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Permitted Structural Analysis Procedures	Any of the indicated procedures can (always) be used.	Equivalent Lateral Force procedure can't be used in several instances.	ASCE 7 12.6/Table 12.6-1	N/A
Magnitude of Redundancy Factor (ρ) for Diaphragm Design	ρ doesn't apply to the design of diaphragms.	ρ applies to the design of diaphragms to include requirements of 12.3.3.4. Also, $\rho = 1.0$ for inertial forces, & $\rho =$ the value used for the structure for transfer forces.	ASCE 7 12.10.1.1	N/A
Design Story Drift (Δ) for Moment-Frame SFRSs	$\Delta \leq$ allowable story drift (Δ_a).	Δ for any story shall be $\leq \Delta_a/\rho$ for SFRSs solely comprising moment frames.	ASCE 7 12.12.1.1	N/A
Deformation Compatibility	Deformation compatibility isn't necessary.	With one (1) exception, every structural component not included in the SFRS in the direction under consideration shall be designed to be adequate for the gravity load effects & seismic forces resulting from displacement due to Δ .	ASCE 7 12.12.5	N/A
ACI 318 Seismic Design Requirements & Concrete Foundations	N/A		ASCE 7 12.13.6 ¹³ - See IBC 1808.8.6 (herein)	N/A
Seismically Exempt Mechanical & Electrical Nonstructural Components	Mech. & elec. components w/ $I_p = 1.0$ are exempt from Ch. 13, Seismic Design Requirements for Nonstructural Components.	In order for mech. & elec. components w/ $I_p = 1.0$ to be exempt from Ch. 13, several conditions must be met.	ASCE 7 13.1.4	N/A
Power-Actuated Fasteners (PAFs)	Unless they're approved for seismic loading, PAFs can't be used in masonry.	Unless they're approved for seismic loading, PAFs can't be used in masonry or, unless the applicable exception is met, in concrete or steel for sustained tension loads or for brace applications.	ASCE 7 13.4.5	N/A
Friction Clips & Support of Sustained Loads in Addition to Seismic Forces	Friction clips can be used w/o limitation.	Friction clips can't be used for supporting sustained loads in addition to resisting seismic forces ¹⁴ .	ASCE 7 13.4.6	N/A
Industry Standard Construction Requirements for Acoustical Tile or Lay-in Panel Ceilings	Design & installation must be per ASTM E580 Sect. 4, ASTM C635, & ASTM C636.	Design & installation must be per ASTM E580 Sect. 5, ASTM C635, & ASTM C636; must meet certain perimeter support conditions; & must include separation joints/ full-height partitions in certain instances.	ASCE 7 13.5.6.2	N/A
Exceptions for Design of Piping Systems & Attachments for Seismic Forces & Relative Displacements	All piping w/ $I_p = 1.0$; & some piping w/ $I_p = 1.5$ if certain conditions apply.	Some piping w/ $I_p = 1.0$, & some w/ $I_p = 1.5$, if certain conditions apply.	ASCE 7 13.6.8.3	N/A
Choices & System Limitations of SFRSs in Nonbuilding Structures Similar to Buildings	There are more choices of SFRSs, & the system limitations associated w/ them are lesser.	There are less choices of SFRSs & the system limitations associated w/ them are more restrictive.	ASCE 7 15.4.1/Table 15.4-1	N/A
Choices & System Limitations of SFRSs in Nonbuilding Structures Not Similar to Buildings	There are more choices of SFRSs, & the system limitations associated w/ them are lesser.	There are less choices of SFRSs & the system limitations associated w/ them are more restrictive.	ASCE 7 15.4.1/Table 15.4-2	N/A
Seismic Design Requirements for Earth-Retaining Structures	N/A	In addition to other requirements, earth-retaining structures must be designed for DSLEPs.	ASCE 7 15.6.1	See IBC 1803.5.12 (herein)

¹³ In addition to the requirements associated w/ IBC 1808.8.6, there are additional requirements for pole-type structures, pile caps, pile design and batter piles (for Structures in SDC D).

¹⁴ C-type beam & large flange clamps are permitted for hangers if equipped w/ restraining straps equivalent to those specified in NFPA 13, Sect. 9.3.7. Lock nuts or equivalent shall be provided to prevent loosening of threaded connections.

Construction & Seismic Design Requirements for Stacks & Chimneys	Stacks & chimneys shall comply w/ 15.6.2.	Stacks & chimneys shall comply w/ 15.6.2, to include additional design & detailing requirements for splices & regions of breachings/openings in concrete stacks & chimneys.	ASCE 7 15.6.2	N/A
Transition from ASCE 7 to AISC 360				
Specification for Structural Steel Buildings doesn't include provisions pertaining to seismic design			ASIC 360-10	N/A
Transition from AISC 360 to AISC 341				
Seismic Provisions for Structural Steel Buildings echoes & reinforces IBC 2205.2			ASIC 341-10	N/A
Transition from AISC 341 to ACI 318				
Structural Members Not Part of the SFRS & Chapter 18, Earthquake-Resistant Structures	Structural members not considered part of the SFRS need not comply w/ Ch. 18.	Structural members not considered part of the SFRS must meet the applicable requirements of Ch. 18 Sect. 18.14 ¹⁵ .	ACI 318-14 4.4.6.5.3	N/A
Diaphragms Part of the SFRS & Ch. 18	Diaphragms need not comply w/ Ch. 18.	Diaphragm design must be per applicable requirements of Ch. 18 Sect. 18.12 ¹⁶ .	ACI 318 4.4.7.6	N/A
Seismic Design Requirements for Foundations			ACI 318 13.2.3.2 - See IBC 1808.8.6 (herein).	N/A
Use of Plain Concrete	Plain concrete can be used as stipulated in Ch. 14, Plain Concrete.	Plain concrete can only be used in footings that are minimally reinforced & that support cast-in-place reinforced concrete or reinforced masonry walls.	ACI 318 14.1.4	N/A
Portions of Ch. 18 That Must Be Satisfied	18.2.1.6, 18.2.1.7, 18.2.2, & 18.2.3 ¹⁷ must be satisfied.	In addition to 18.2.1.6, 18.2.1.7, 18.2.2 & 18.2.3, the following must be satisfied: 18.2.4 - 18.2.8, & 18.12 - 18.14 ¹⁸ .	ACI 318 18.2.1	N/A
Design of Wall Piers in Intermediate Precast Concrete Shear Walls	There are no seismic provisions applicable to wall piers.	Wall piers shall be designed per 18.10.8 ¹⁹ or 18.14.	ACI 318 18.5.2.3	N/A
Min. Specified Compressive Strength of Concrete (f'_c) For SMFs & SSWs	Normal-weight concrete: $f'_c \geq 3$ ksi Lightweight Concrete: $3 \text{ ksi} \leq f'_c \leq 5 \text{ ksi}$	Normal-weight concrete: $f'_c \geq 3$ ksi Lightweight Concrete: $3 \text{ ksi} \leq f'_c \leq 5 \text{ ksi}$	ACI 318 19.2.1.1 ²⁰	N/A
Materials, Strengths & Types Of Nonprestressed Reinforcement Used in Special Seismic Systems (SSSs)	Refer to the SSSs rows of Tables 20.2.2.4a (for deformed bars) & 20.2.2.4b (for plain bars).	Refer to the SSSs rows of Tables 20.2.2.4a (for deformed bars) & 20.2.2.4b (for plain bars).	ACI 318 20.2.2.4 ²¹	N/A
Modification of Strength Reduction Factor (ϕ) For Shear For Structures Resisting Earthquake Effects	In special moment frames (SMFs), & in special structural walls (SSWs), ϕ shall be as indicated in 21.2.4.1 – 21.2.4.3.	In special moment frames, special structural walls, & in intermediate precast structural walls, ϕ shall be as indicated in 21.2.4.1 – 21.2.4.3.	ACI 318 21.2.4 ²²	N/A

¹⁵ Members not designated as part of the seismic force-resisting system.

¹⁶ Diaphragms and trusses

¹⁷ The topics/titles of the portions of Ch. 18 listed in the SDC C column are as follows (in the order in which they occur): Structural systems designated as part of SFRS, Structural systems not included in Ch. 18, Analysis and Proportioning of Structural Members, & Anchoring to Concrete

¹⁸ The titles of the portions of Ch. 18 listed in the SDC D column (other than 18.2.1.6, 18.2.1.7, 18.2.2 & 18.2.3) are as follows (in the order in which they occur): Strength reduction factors, Concrete in special moment frames and special structural walls, Reinforcement in special moment frames and special structural walls, Mechanical splices in special moment frames and special structural walls, Welded splices in special moment frames and special structural walls, Diaphragms and trusses, Foundations, & Members not designated as part of the SFRS.

¹⁹ Wall piers in special structural walls.

²⁰ 19.2.1.1 is referred to by 18.2.5 (Concrete in SMFs & SSWs). Since SMFs & SSWs aren't required for use in SDC C, 18.2.5 isn't indicated in the preceding row that lists applicable portions of Ch. 18. However, if these systems are used SDC C, 19.2.1.1 must be satisfied (since it doesn't indicate otherwise). This explains why this provision is included herein even though there's no difference in its effect on SDC C vs. D.

²¹ See footnote 21 since similar applies here.

²² See footnote 21 since similar applies here.

Reduction of Development Length For Reinforcement In SFRSs	Reduction of development length in accordance with 25.4.10.1 is permitted ²³ .	Reduction of development length in accordance with 25.4.10.1 isn't permitted.	ACI 318 25.4.10.2	N/A
Transition from ACI 318 to AISI S100				
Restrictions For Curtain Wall Studs	There are no SDC-based restrictions for curtain wall studs.	When material ductility is determined on the basis of the local & uniform elongation criteria of Sect. A2.3.5, curtain wall studs are limited to the dead load of the curtain wall assembly divided by its surface area, but not > 15 psf.	AISI S100-12 A2.3.5a	N/A
Transition from AISI S100 to AISI S213				
Sheathing Materials For Cold-formed Steel (CFS) Framed Wall Systems	Subject to four (4) conditions, fiberboard-sheathed, Type-I shear walls are permitted (in addition to steel-, wood- & gyp.-bd.-sheathed walls).	Fiberboard-sheathed shear walls aren't permitted.	AISI S213-07/S1-09(2012) C2.2.4	N/A
Transition from AISI S213 to TMS 402/ACI 530/ASCE 5				
Use of Masonry Columns	If constructed per four (4) provisions, masonry columns are permitted for support of light-frame roofs of carports, porches, sheds or similar structures when unfactored gravity loads are ≤ 2 kips acting within the cross-sectional dimensions of the column.	Masonry columns aren't permitted.	TMS 402/ACI 530/ASCE 5-13 5.3.2	N/A
Seismic Design & Detailing of Masonry Elements	Masonry elements shall satisfy requirements in 7.4.3.1 & 7.4.3.2 (in addition to those for SDC B). See table, Requirements for Masonry Elements, on last pp. herein for specifics.	Masonry elements shall satisfy requirements in 7.4.4.1 & 7.4.4.2 (in addition to those for SDC C). See table, Requirements for Masonry Elements, on last pp. herein for specifics.	TMS 402 7.4.3 & 7.4.4	N/A
Prescriptive Design & Detailing of Anchored Veneer	12.2.2.10.1 requires isolation of the sides & top of anchored veneer from the structure so that vertical & lateral seismic forces resisted by the structure are not imparted to the veneer.	In addition to 12.2.2.10.1, the following are required: - Reduce the maximum wall area supported by each anchor to 75% of that required in Sections 12.2.2.5.6.1 & 12.2.2.5.6.2. Maximum horizontal & vertical spacings are unchanged. - For masonry veneer anchored to wood backing, attach each veneer anchor to wood studs or wood framing with a corrosion-resistant 8d ring-shank nail, a No. 10 corrosion-resistant screw with a minimum nominal shank diameter of 0.190" or with a fastener having equivalent or greater pullout strength.	TMS 402 12.2.2.10	N/A
Prescriptive Design of Masonry Partition Walls	The prescriptive design requirements of Ch. 14, Masonry Partition Walls, apply.	The prescriptive design requirements of Ch. 14 aren't applicable.	TMS 402 14.2.3.3	N/A
Empirical Design of Masonry	Except for the SFRS, empirical requirements apply to the design of masonry for buildings, parts of buildings or other structures.	Empirical requirements don't apply to the design of masonry for buildings, parts of buildings or other structures.	TMS 402 A.1.2.2	N/A

²³ In addition to the SDC-D prohibition, 25.4.10.2 lists four (4) other conditions that aren't related to SDC. If any of these other conditions apply, reductions of development length aren't permitted.

Requirements for Masonry Elements: SDC C (7.4.3.1 – 7.4.3.2.5) versus SDC D (7.4.4.1 – 7.4.4.2.3)

Element Type	SDC C	SDC D ²⁴
Nonparticipating ²⁵		
- Horizontal Reinforcement	Min. 2 longitudinal wires of W1.7 bed joint reinf. spaced < 16" on center for walls > 4" in width & min. 1 longitudinal W1.7 wire spaced < 16" on center for walls < 4" in width or > 1 #4 bar spaced < 48" on center ²⁶ . Where 2 wires are used, the space between them shall be the widest that the mortar joint will accommodate. Horizontal reinf. shall be provided within 16" of the top and bottom of these masonry walls.	Same
OR		
- Vertical Reinforcement	Min. 1 #4 spaced ≤ 120" & within 16" of ends of walls	At least 1 #4 spaced ≤ 48" & within 16" of ends of walls
Participating ²⁷		
- Connections to masonry columns	Where anchor bolts are used to connect horizontal elements to the tops of columns, they shall be placed within lateral ties. The ties shall enclose both the vertical bars in the column and the anchor bolts. There shall be ≥ 2 #4 lateral ties provided in the top 5" of the column.	N/A
- Anchorage of floor & roof diaphragms in AAC masonry	Seismic load between floor & roof diaphragms & AAC masonry shear walls shall be transferred through connectors embedded in grout & designed in accordance with Section 4.1.4.	N/A
- Material requirements	ASTM C34, structural clay load-bearing wall tiles, shall not be used as part of the SFRS.	Fully grouted: Design & specify w/ Type S or Type M cement-lime mortar, masonry cement mortar, or mortar cement mortar. Partially grouted: Design & specify w/ Type S or Type M cement-lime mortar or mortar cement mortar.
- Lateral stiffness	At each story level, ≥ 80% of the lateral stiffness shall be provided by seismic-force-resisting walls. Along each line of lateral resistance at a particular story level, ≥ 80% of the lateral stiffness shall be provided by seismic-force-resisting walls. Where seismic loads are determined based on R ≤ 1.5, piers & columns are permitted to be used to provide seismic load resistance.	N/A
- Design of columns, pilasters & beams supporting discontinuous elements	Columns & pilasters that are part of the SFRS & that support reactions from discontinuous stiff elements shall be provided with transverse reinforcement spaced ≤ ¼ of the least nominal dimension of the column or pilaster. The min. trans. reinf. ratio = be 0.0015. Beams supporting reactions from discontinuous walls shall be provided with trans. reinf. spaced at ≤ 1/2 of the nominal depth of the beam. The min. trans. reinf. ratio = 0.0015.	N/A
- Minimum reinforcement for masonry columns	N/A	Lateral ties shall be spaced ≤ 8" o.c. of diameter ≥ 3/8" in., & embedded in grout.
- Lateral tie anchorage	N/A	Standard hooks shall be either a 135° standard hook or a 180° standard hook.

²⁴ Listed in the SDC-D column are ONLY those provisions that are "above & beyond" 7.4.4, which is the provision that requires SDC D to meet all requirements for SDC C.

²⁵ What's stated herein isn't applicable to nonparticipating masonry elements constructed of AAC masonry in either SDC. In addition to what's stated herein, nonparticipating elements in SDC C must comply w/ Sect. 7.3.1, Chs. 8 – 11 & 14, App. A or App. B; and the same goes for SDC D except that Ch. 14 (Masonry Partition Walls) & App. A (Empirical Design of Masonry) aren't applicable.

²⁶ From ACI 318 App. A, 2 W2 wires @ 16" o.c. = 2 (0.015 in²) = 0.03 in², 1 W2 @ 16" = 0.015 in², & 1 #4 @ 48" = 0.05 in²; thus, the area provided by the latter exceeds that provided by both of the former (since W2 is larger than W1.7) & no punctuation is necessary within this standard requirement/language.

²⁷ In addition to what's stated herein, participating elements in SDC C must comply w/ Sect. 8.3, 9.3, 11.3 or App. B; & masonry shear walls shall be designed to comply with the requirements of Section 7.3.2.4, 7.3.2.5, 7.3.2.6, 7.3.2.9, 7.3.2.11, or 7.3.2.12. In SDC D, participating elements must comply w/ Sect. 7.4.3 and with the additional requirements of Sections 7.4.4.1 and 7.4.4.2; however, AAC masonry shall comply w/ 7.4.3.

RECORD OF REVISIONS

Rev	Date	Description	Author
0	3/25/21	Initial issue. Fifth column listed several Master Spec sections and SSI that were specific to SDC D.	Glen Pappas, <i>ES-EPD</i>
1	5/19/21	Fifth column's reference to LMS and SSI deleted because those standards were revised to add wording relevant to SDC C.	Glen Pappas, <i>ES-EPD</i>